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Naval Weapons Station Concord

Concord, California
CERCLIS #CA7170024528

Site Exposure Potential

The Naval Weapons Station (NWS) at Concord, California has operated since 1942 and is the U.S. Navy's major ammunition transshipment port on the West Coast. NWS Concord is on the south shore of Suisun Bay, about 50 km north-east of San Francisco (Figure 1). Suisun Bay connects to San Francisco Bay through San Pablo Bay, about 15 km west of the facility. San Francisco Bay flows directly into the Pacific Ocean.

The 5,200-hectare NWS is divided into two principal areas: the Tidal Area and the Inland Area (Figure 2). The Tidal Area encompasses

about 3,100 hectares along Suisun Bay, plus seven islands and two islets of the Seal Islands in the bay north of the station. The Tidal Area contains the four Remedial Action Subsites composed of the eight parcels also known as the "litigation sites." The Tidal Area is used for ordnance operations and includes a pier, rail car complex, facilities for ammunition segregation and transfer, warehouses, support buildings, landfill, woodhogger, and dunnage yard. Most of the islands are leased for agriculture and recreational hunting. Industrial activity continues at six nearby contaminated properties owned by Allied-Signal, Inc., Chemical & Pigment Company,

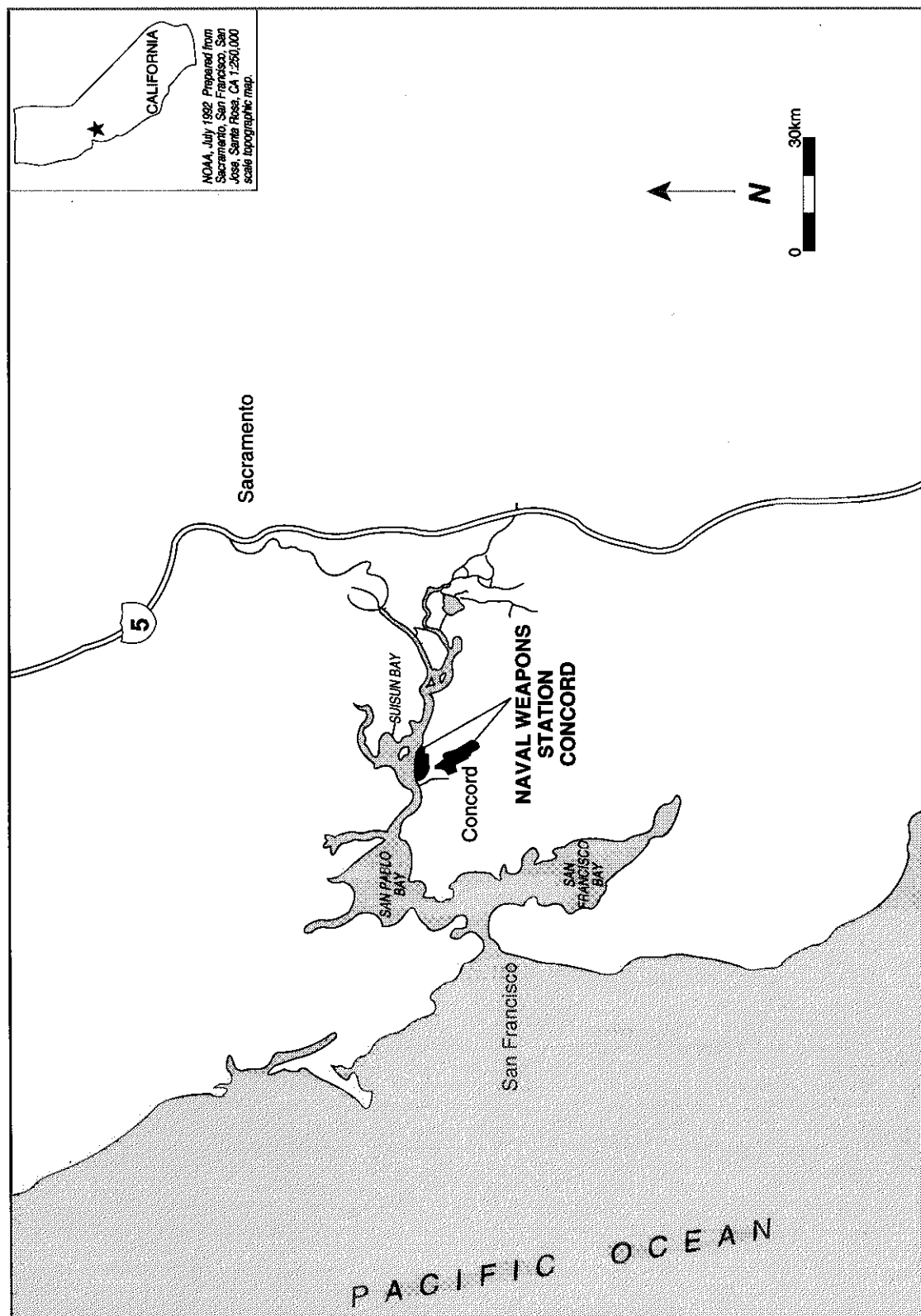


Figure 1. Naval Weapons Station Concord, Concord, California.

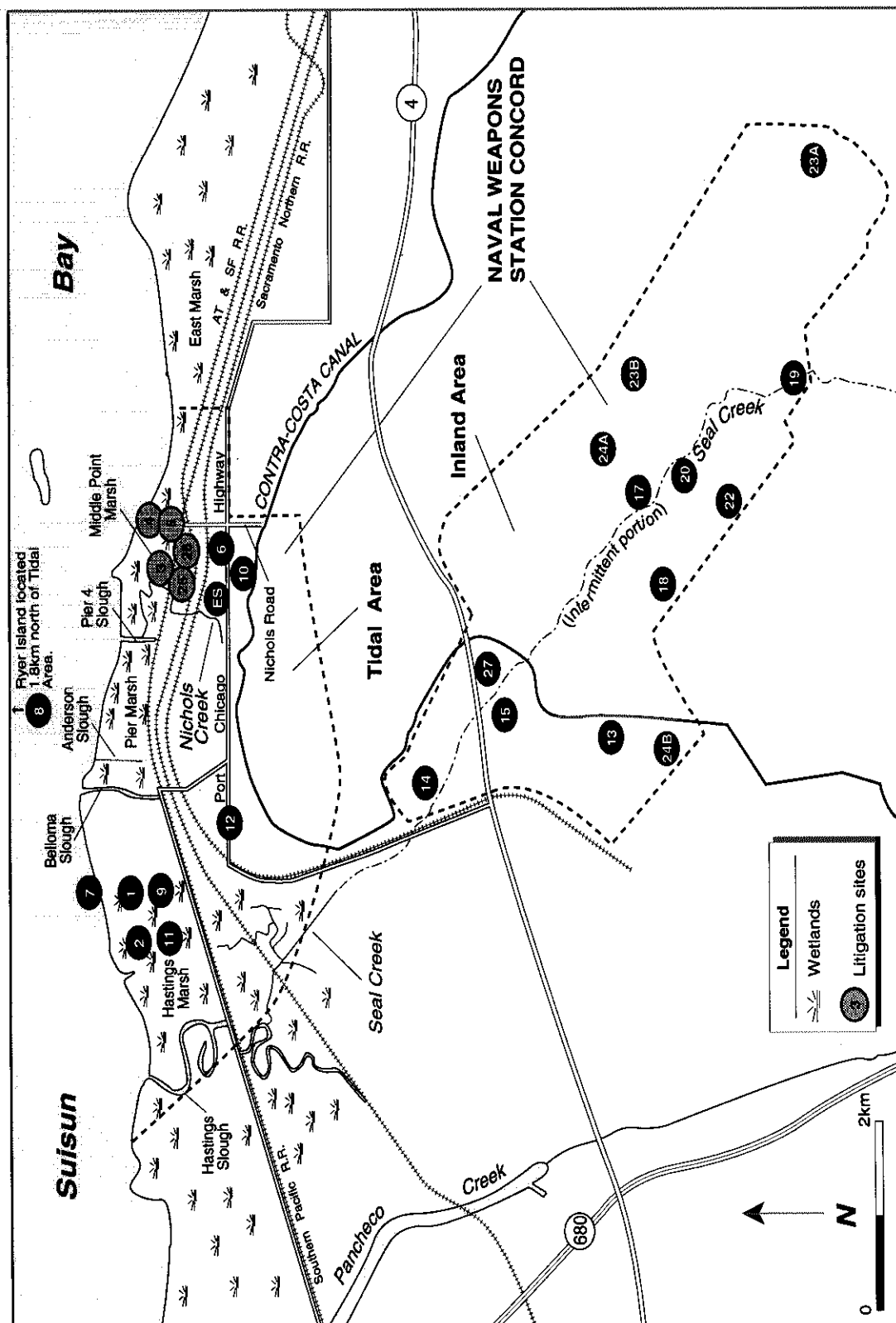


Figure 2. The Naval Weapons Station in Concord, California (Ecology and Environment 1983; Lee et al. 1986; IT Corporation 1991). Site locations are approximate.

Sacramento Northern Railroad Company, Atchison, Topeka & Santa Fe Railroad Company, and the Southern Pacific Transportation Company. The 2,100-hectare Inland Area, used primarily for ammunition storage, includes production facilities and the Weapons Quality Engineering Center. At least 28 potentially contaminated sites have been identified within these two areas: 15 in the Tidal Area and 13 in the Inland Area (Ecology and Environment 1983; IT Corporation 1992; PRC and J.M. Montgomery 1992; Table 1).

An Initial Assessment Study of the Concord site was completed in 1983 (Ecology and the Environment 1983). A remedial investigation and a feasibility study were completed in 1986 and 1988, respectively, for sites in the eastern portion of the Tidal Area (Kendall and Lunz 1986; Lee et al. 1988). Remedial investigations are in progress for Sites 1, 2, 9, and 11 of the Tidal Area, and for all sites in the Inland Area except Site 15 (IT Corporation 1992; PRC and J.M. Montgomery 1992).

Surface water runoff, direct discharge, and groundwater are the potential pathways of contaminant transport from the site to NOAA trust resources and associated habitats. Surface water within the Tidal Area that may receive overland flow from source areas include the Contra Costa Canal, several creeks and sloughs, mosquito control ditches, and wetlands. Except for the Contra Costa Canal, which flows south away from the site, these surface water features discharge either directly or indirectly to Suisun Bay (Lee et al. 1986). Seal Creek, an intermittent

stream that traverses the Inland Area and eventually discharges to the bay, may receive surface water runoff from both the Tidal and Inland areas via sumps and drainage ditches. Direct discharges to Suisun Bay may also occur as a result of tidal flooding of the Tidal Area sites. Waste materials have also been observed in the Tidal Area wetlands (IT Corporation 1992).

Shallow groundwater beneath the Tidal Area ranges from immediately below ground surface to 1.5 m below ground surface (IT Corporation 1992). Beneath the Inland Area, shallow groundwater occurs from 9 to 12 m below ground surface (PRC and J.M. Montgomery 1992). Shallow groundwater throughout the NWS generally flows north toward Suisun Bay.

NOAA Trust Habitats and Species

Suisun Bay is the primary NOAA trust habitat of concern near NWS Concord. Secondary potential habitats of concern include the on-site wetlands, ditches, sloughs, and creeks (Figure 2). Suisun Bay is a transition zone between the saltwater ecosystem of San Francisco Bay and the freshwater ecosystems of the Sacramento and San Joaquin rivers, which drain into Suisun Bay about 20 km east of the NWS. Salinities in the vicinity of the site generally range from 2 to 16 ppt, but fluctuate as a result of tides, rainfall, saltwater

Table I. Waste disposal areas, periods of use, and waste types and quantities identified at NWS Concord.

Disposal Area	Period of Use	Waste Types	Estimated Waste Quantity
TIDAL AREA SITES			
Tidal Area Landfill (Site 1)*	1944-1979	solvents, acids, paints, creosote, asbestos, ordnance, general wastes	30,000,000 kg
R Area Disposal Site (Site 2)*	1940s-1976	paints, solvents, inert ordnance	590,000 kg
Coke Pile (CP; Site 6)*	20 years ^a	spent coke, inorganic substances	1,100 m ³
1944 Explosion Docks (Site 7)	1944	unexploded ordnance	unknown
Ryer Island (Site 8)	1944	unexploded ordnance	2 boxcars
Froid & Taylor Roads Site (Site 9)*	1944-1979	ordnance, scrap metal	46 m
Nichols Road Site (Site 10)	at least since 1962 ^a	spent coke	38 m ³
Wood Hogger Site (Site 11)*	1968-1973	PCP-contaminated wood	20 tons
Port Chicago Site (Site 12)	1930s-1976	unknown	unknown
Litigation Sites			
Kiln Site (KS; Site 3)*	unknown	inorganic substances	unknown (2 ha) ^b
Allied Site A (AA; Site 4)*	20 years ^a	inorganic substances	unknown (1.2 ha) ^b
Allied Site B (AB; Site 5)*	20 years ^a	inorganic substances	unknown (2 ha) ^b
K-2 (Site 25)*	unknown	refinery wastes, coke debris	unknown (2 ha) ^b
G-1 (Site 26)*	20 years ^a	refinery wastes	unknown (2.4 ha) ^b
ES*	20 years ^a	inorganic substances	unknown
INLAND AREA SITES			
Burn Area (Site 13)	1944-1979	powder, flares, napalm	230,000 kg
Kinne Boulevard Wells (Site 14)	1960s	fuel oil, miscellaneous chemicals	unknown
Railroad Classification Yard (Site 15)	unknown	methyl bromide vials, spent ordnance	4 10-cm vials; several casings
Building IA-24 (Site 17)	1950s-1974	battery acid, lead	380,000 l
Building IA-25 (Site 18)	1950s-present	paints, solvents	3,800 l
Seal Creek Disposal Area (Site 19)	1950s-present	asphalt, construction debris, miscellaneous wastes	77 m ³
Old Homestead, Seal Creek (Site 20)	pre-1943 ^a	household debris	4 m ³
Building 7SH5 (Site 22)	1950s-1970s	solvents, paints, cleaners	1,900 L
Inland Area EOD (Site 23A)	1940s-1959	explosives	<900 kg
Eagle's Nest EOD (Site 23B)	1959-1970s	explosives	<900 kg
Pistol Firing Range (Site 24A)	25 years ^a	ammunition	<9,000 kg
Aircraft Firing Range (Site 24B)	unknown	ammunition	<9,000 kg
Building IA-20 (Site 27)	1964-1968	Freon 113, hydraulic fluids	unknown
^a Actual period of use unknown. ^b Approximate area of contaminated soil. *Contaminant data available for these sites only.			

intrusion, and agricultural runoff (Nichols and Pamatmat 1988).

There are four major wetlands along Suisun Bay within the boundaries of the NWS: Hastings Marsh in the western portion of the Tidal Area;

Pier and Middle Point marshes in the north-central section of the Tidal Area; and East Marsh in the eastern portion of the Tidal Area (Figure 2). Hastings Marsh is drained primarily by Hastings Slough, which traverses the westernmost portion of the marsh and receives discharge from

Seal Creek. Middle Point Marsh is traversed by Nichols Creek, which receives periodic discharges from the Contra Costa Canal during flooding. The Pier and Middle Point marshes are also drained by the Belloma, Anderson, and Pier 4 sloughs. In addition, there is a series of mosquito control ditches throughout the four major wetlands.

A majority of these four wetland areas are north of the Southern Pacific and ATSF railroads (Figure 2). This area is tidally influenced and the wetlands are primarily brackish water. There is a 1-m tidal range within these wetlands (Lee et al. 1986). The brackish water wetlands are dominated by five plant community types: saltwort (*Salicornia*) and saltgrass (*Distichlis*) dominate the upland areas, bulrush (*Scirpus*) dominates the wetlands that are periodically inundated, while rush (*Juncus*) and cattail (*Typha*) dominate the deeper-water habitats near Suisun Bay and in some areas along the Port Chicago Highway and Frontage Road. Wetlands south of the Southern Pacific Railroad are freshwater and it is not known whether they are subject to direct tidal action. They include the southern portions of Hastings and Middle Point marshes, plus small pockets of freshwater wetlands in low-lying areas.

Suisun Bay forms a migration corridor and nursery area for seven species of anadromous fish: green sturgeon, white sturgeon, delta smelt, chinook salmon, steelhead trout, striped bass, and American shad (Table 2; Bybee personal communication 1990; Kholhorst personal communication 1992). The winter-run chinook salmon is a federally threatened species. The U.S. Fish and

Wildlife Service is currently petitioning for similar status for delta smelt (IT Corporation 1992). All seven anadromous species spawn in the Sacramento and San Joaquin rivers upstream of the site, as well as in their tributaries. The largest populations are in the mainstem of the Sacramento River. The confluence of the San Joaquin and Sacramento rivers is an important congregation area during upstream and downstream anadromous fish migrations, particularly for chinook salmon, steelhead trout, and sturgeon. Striped bass and delta smelt are known to spawn in Suisun Bay. During periods of high salinity, Dungeness crab and bay shrimp are also present near the site (Wooster personal communication 1989; Kholhorst personal communication 1992).

Little is known about species use of the habitats within the on-site wetlands, ditches, sloughs, and creeks, although the sloughs are the principal access points for any fish species entering the on-site wetlands. Water levels within the sloughs are extremely low during dry periods, restricting fish from entering the wetlands from the sloughs. Low water levels in Hastings Slough also likely limit the upstream migration of trust species to the lower reaches of Seal Creek. In addition, high water temperatures and low dissolved oxygen may limit the use of the on-site sloughs by fish. Although it is possible that striped bass use the wetlands on the NWS for nursery habitat, the dominant fish community in these wetlands is likely to be a freshwater minnow-type species (*cyprinids*; Lee et al. 1986; Wooster personal communication 1989). The Contra Costa Canal is an irrigation system hydraulically connected to

Table 2. Selected fish species present in San Pablo Bay, Suisun Bay, and the Sacramento River near Naval Weapons Station Concord, Concord (Bybee personal communication 1990; Kholhorst personal communication 1992).

Species		Habitat				Fisheries	
Common Name	Scientific Name	Spawning Ground	Nursery Ground	Adult Forage	Migratory Route	Comm.	Recr.
ANADROMOUS SPECIES							
Green sturgeon	<i>Acipenser medirostris</i>		♦	♦	♦		♦
White sturgeon	<i>Acipenser transmontanus</i>		♦	♦	♦		♦
American shad	<i>Alosa sapidissima</i>		♦	♦	♦		♦
Delta smelt	<i>Hypomesus transpacificus</i>	♦	♦	♦			
Striped bass	<i>Morone saxatilis</i>	♦		♦	♦		♦
Steelhead trout	<i>Oncorhynchus mykiss</i>		♦	♦	♦		♦
Chinook salmon	<i>Oncorhynchus tshawytscha</i>		♦	♦	♦		♦
NON-ANADROMOUS SPECIES							
Shiner perch	<i>Cymatogaster aggregata</i>	♦	♦	♦			
Starry flounder	<i>Platichthys stellatus</i>		♦	♦			
INVERTEBRATE SPECIES							
Dungeness crab	<i>Cancer magister</i>		♦	♦			
Bay shrimp	<i>Crangon</i> spp.			♦		♦	

on-site wetlands only during flooding events (Lee et al. 1986). It is unlikely that this canal provides habitat for any NOAA trust species.

There are no commercial fisheries near the site, although commercial bait fishing for Bay shrimp extends into the lower reaches of Suisun Bay during periods of abnormally high salinity (Hergeshell personal communication 1989). Sport fishing for anadromous fish, except delta smelt and winter-run chinook salmon, coincides with seasonal runs. In general, chinook salmon are caught in the fall and steelhead trout during the winter. There are no restrictions on these fisheries other than general regulations on take limit and minimum sizes (Wolcott personal communication 1989; Kholhorst personal communication 1992).

In 1984, NWS Concord and the U.S. Fish and Wildlife Service designated Middle Point Marsh as a Wetland Preserve along with four other mainland wetlands and six island areas. The locations of the other wetland areas designated as Wetland Preserves were not clear in the documentation. A National Wildlife Refuge may be established on the areas designated as Wetland Preserve (O'Neil 1986).

Site-Related Contamination

Data collected during site investigations indicate that groundwater and surface water (Table 3), and

soil and sediment (Table 4) at the NWS Concord site contain elevated concentrations of site-related contaminants (Lee et al. 1986, 1988; IT Corporation 1991, 1992). Some of these contaminants were also detected in tissue samples of clams (*Corbicula fluminea*) collected from the site (Table 5; Lee et al. 1986; IT Corporation 1992). The primary contaminants of concern to NOAA are trace elements, arsenic, pesticides, PCBs, and PAHs. Secondary contaminants of concern include explosive compounds.

Contaminant data were available only for eleven sites in the Tidal Area (Table 1). Four of these sites (Sites 1, 2, 9, and 11) are in Hastings Marsh; contaminant data for these sites were compiled from site investigations conducted from 1988 to 1991 (IT Corporation 1991, 1992). The remaining seven sites (Sites 3, 4, 5, 6, 25, 26, and ES) are in or near Middle Point Marsh; data from these sites were compiled from 1984 site investigations (Lee et al. 1986, 1988). Not all contaminants were analyzed for in all media.

Bioaccumulation studies using the Asiatic clam (*C. fluminea*) were conducted for Middle Point Marsh during 1984 and 1986 and for Hastings Marsh during 1988 and 1989. Tissues were analyzed for trace elements, VOCs, pesticides, and PCBs. Not all analytes were tested for during each study. No toxicity tests have been conducted at the site.

Background samples were collected for all media. However, concentrations of several trace elements in these samples exceeded their screening guidelines by up to three orders of magnitude.

The background sampling locations were located close to a working pier area that may have exhibited local contamination. Therefore, measured background concentrations probably do not represent background conditions.

Concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc in soils collected from the Tidal Area sites in Hastings Marsh exceeded average U.S. concentrations for these inorganic substances in soils. Except for arsenic, these trace elements were also detected in groundwater from sites in Hastings Marsh at concentrations exceeding chronic AWQC (U.S. EPA 1986) by factors greater than ten. Fewer trace elements were detected in surface water samples from these sites, but detection limits for many of the trace elements in surface water were greater than their AWQC. Except for cadmium and silver, all of the trace elements detected in soils were also measured at elevated concentrations in sediments from the Tidal Area sites in Hastings Marsh. Concentrations of chromium, copper, lead, mercury, silver, and zinc measured in tissues of *C. fluminea* collected from several locations in Hastings Marsh were greater than those concentrations measured in clam tissues collected from site background locations.

Arsenic, cadmium, copper, lead, mercury, nickel, and zinc were detected in soil samples collected from Tidal Area sites in Middle Point Marsh at concentrations greater than average U.S. soils concentrations. Of these trace elements, concentrations of cadmium, copper, and lead detected in groundwater samples exceeded their AWQC by

Table 3. Maximum concentrations of trace elements detected in groundwater and surface water samples from Tidal Area sites in Hastings and Middle Point marshes at NWS Concord.

	Groundwater (µg/l)			Surface Water (µg/l)		AWQC ¹ (µg/l)
	Hastings Marsh Sites ²	Middle Point Marsh Sites ³	Site Background ^{2,3}	Hastings Marsh Sites ⁴	Site Background ⁵	
Arsenic	140	57	7.6	7	<10	36
Cadmium	190	40	<3.0	<5	<100	1.1 ⁺
Chromium	1,400	NT	NR	<10	<200	11
Copper	170	220	46	19	<500	2.9 ⁺
Lead	130	240	58	<48	<10	3.2 ⁺
Mercury	0.56	NT	NR	<0.3	0.3	0.012
Nickel	3,400	NT	NR	130	<800	8.3
Silver	110	NT	NR	<7	<100	0.12
Zinc	5,000	200	120	110	<400	86

¹ Because the site is part of an estuarine system, the data presented are the lower of freshwater and marine chronic AWQC (U.S. EPA 1986).
² Data compiled from 1990 and 1991 sampling events (IT Corporation 1991, 1992).
³ Data compiled from 1984 through 1987 sampling events (Lee et al. 1986, 1988).
⁴ Data compiled from 1988, 1989, and 1990 sampling events (IT Corporation 1992).
⁵ Data compiled from 1988 and 1989 sampling events; 1990 data were not presented (IT Corporation 1992).
⁺: Hardness-dependent criteria (100 mg/l CaCO₃ used).
^{*}: Acute criterion presented; chronic criterion not available.
< Not detected at detection limit shown.
NR: Data not reported; it was not clear in the available documentation if the chemical was analyzed for.
ND: Not detected at method detection limit.
NT: Not tested.

Table 4. Maximum concentrations of trace elements detected in soil and sediment samples collected from Tidal Area sites located in Hastings and Middle Point marshes at NWS Concord.

	Soil (mg/kg)				Sediment (mg/kg)				
	Hastings Marsh Sites ¹	Middle Point Marsh Sites ²	Site Background ^{1,2}	Average U.S. ³	Hastings Marsh Sites ⁴	Middle Point Marsh Sites ²	Site Background ⁴	ER-L ⁵	
Arsenic	530	1,500	93	5	38	3,500	52	33	
Cadmium	9.0	88	3	0.06	2.3	70	1.4	5	
Chromium	150	NT	81	100	84	NT	NR	80	
Copper	4,800	11,000	10,000	30	640	1,400	98	70	
Lead	4,700	7,800	170	10	1,600	530	180	35	
Mercury	0.79	NT	0.43	0.03	1.5	NT	NR	0.15	
Nickel	240	260	87	40	110	104	NR	30	
Silver	3.6	NT	<3.0	0.05	<2.2	NT	NR	1	
Zinc	5,500	85,000	3,700	50	640	5,600	190	120	

¹ Data compiled from 1989 through 1991 sampling events (IT Corporation 1992).
² Data compiled from 1984 through 1987 sampling events (Lee et al. 1986, 1988).
³ Lindsay (1979).
⁴ Data compiled from 1990 sampling event (IT Corporation 1992).
⁵ Effects range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
< Not detected at detection limit shown.
NR: Data not reported; it was not clear in the available documentation if the chemical was analyzed for.
NT: Not tested.

Table 5. Maximum concentrations of trace elements measured in tissues of *Corbicula fluminea* collected from Tidal Area sites located in Hastings and Middle Point marshes at NWS Concord.

	Hastings Marsh Sites ¹ mg/kg	Middle Point Marsh Sites ² mg/kg	Site Background ¹ mg/kg
Arsenic	ND	2.6	ND
Cadmium	<0.7	2.7	<0.3
Chromium	4.2	NT	1.3
Copper	14	88	12
Lead	1.1	9.2	<0.5
Mercury	0.2	NT	<0.5
Nickel	ND	10	ND
Silver	5.2	NT	<0.5
Zinc	53	280	21
¹ Data compiled from 1988 and 1989 sampling events (IT Corporation 1992).			
² Data compiled from 1984 and 1986 sampling events (Lee et al. 1986, 1988).			
< Not detected at detection limit shown.			
ND: Not detected at method detection limit.			
NT: Not tested.			

factors greater than ten. All of the trace elements detected in soils from the sites sampled in Middle Point Marsh were also measured at elevated concentrations in sediment samples collected from these sites. Surface water samples were not collected from any of the Tidal Area sites in Middle Point Marsh. Arsenic, cadmium, copper, lead, nickel, and zinc were detected in clam tissues from locations in the marsh at concentrations greater than those measured in site background clam tissues.

Beta-BHC (12 mg/kg), dieldrin (34 mg/kg), DDT (0.62 mg/kg), and chlordane (0.42 mg/kg) were detected in soils from Tidal Area sites in Hastings Marsh. PCBs (1,800 mg/kg) were also detected in soils from these sites. These organic compounds were not analyzed for in media from the Tidal Area sites in Middle Point Marsh; there are no screening guidelines for pesticides or PCBs in soils.

Concentrations of pesticides and PCBs exceeding screening guidelines were not detected in any groundwater or surface water samples collected from the Tidal Area sites.

PAHs were detected at a maximum total concentration of 190 mg/kg in soils from the sites in Hastings Marsh. Only low concentrations of these organic compounds were detected in soils from Middle Point Marsh. There are no screening guidelines for PAHs in soils. Concentrations of PAHs exceeding screening guidelines were not detected in any groundwater or surface water samples collected from the Tidal Area sites.

Explosive compounds, including diphenylamine (130 µg/kg), nitrobenzene (1,000 µg/kg), and 2,6-dinitrotoluene (160 µg/kg) were detected in soil samples collected from sites in Hastings Marsh. These compounds were not analyzed for in media from the sites in Middle Point Marsh.

However, since there are no screening guidelines for explosive compounds in soil, no conclusions could be drawn about these concentrations. Explosive compounds were not detected in any groundwater or surface water samples analyzed from the Tidal Area sites.

Summary

NOAA is mainly concerned about contamination in Suisun Bay and wetland habitats near the bay. Bioassessments have shown that contaminants are mobile and have accumulated in biological receptors in the wetlands. No toxicity testing has been done and no investigations have been conducted in Suisun Bay. Sediments and biota in these habitats need to be sampled and analyzed for both inorganic and organic contaminants.

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